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THE INTERRELATIONSHIPS BETWEEN
BANKING RETURNS AND RISKS

Working Paper 80-122*

by

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The primary purposes of this paper are to identify: (1) the key measures of returns made and of risks taken for a commercial bank, and (2) the interrelationships between those returns and risks. In my opinion, banks will have to take risks in the 1980's in order to make acceptable returns and it will be increasingly important for banks to be able to measure those risks to produce acceptable returns during the coming period of challenging external factors and deregulation.

Financial Statements for An Example Bank

An example commercial bank in a hypothesized environment will be used to illustrate how to measure returns, risks, and their interrelationships. Table 1 presents the basic assumptions for the hypothesized environment in which the sample bank must operate. While the hypothesized environment is not meant to be representative of any particular time period, the reserves, revenues, and expenses are not far from those which existed in late 1980. Furthermore, the relationships between rates are reasonably representative of many periods of time. Short-term securities yield twelve percent versus fourteen percent on long-term securities because of the greater price fluctuations (interest rate risk) on the long-term securities. Loans tend to yield more than securities because of the greater credit risk on loans. Also, higher quality loans yield less than lower quality loans and variable-rate loans tend to yield less than fixed-rate loans. On the cost side, transaction deposits cost less than time deposits but have higher required reserves and may cause more liquidity pressures on assets. Long-term time deposits cost more than shorter-term ones.

The example bank, Smithville Bank, is a \$100 million-asset bank operating in this environment. The balance sheet and income statements for Smithville are summarized in Table 2. It is assumed that Smithville Bank has been able to obtain \$40 million in transaction deposits, \$25 million in short-term time deposits, and \$25 million in longer-term time deposits. Furthermore, the bank has chosen to borrow an additional \$3 million and has equity capital totaling \$70 million. In employing these funds the bank had to hold \$6.3 million in reserves--twelve percent of \$40 million of transaction deposits and three percent of \$50 million of time deposits. The bank's management chose to leave \$15 million in liquid short-term securities and had lent \$20 million respectively in high-quality, variable-rate loans; low-quality, variable-rate loans; and fixed-rate loans. The remaining \$18.7 million was invested

Table 1

HYPOTHESIZED ENVIRONMENT

Reserve Requirements:

| | |
|----------------------|-----|
| Transaction Deposits | 12% |
| Time Deposits | 3% |

Potential Earnings Available:

| | |
|-------------------------------------|-----|
| Short-term Securities | 12% |
| Long-term Securities (currently) | 14% |
| High-quality, Variable-rate Loans | 15% |
| Medium-quality, Variable-rate Loans | 17% |
| Fixed Rate Loans (currently) | 16% |

Expenses in Environment:

| | |
|--------------------------|---------|
| Transaction Deposits | 6% |
| Short-term Time Deposits | 11% |
| Long-term Time Deposits | 13% |
| Borrowings | 13% |
| Other Expenses | \$2 Mm. |
| Income Tax Rate | 45% |

Table 2

SMITHVILLE BANK

Balance Sheet (000 omitted)

| <u>Assets:</u> | | <u>Liabilities:</u> | |
|-------------------------|------------------|--------------------------|------------------|
| Cash and Due from Banks | \$ 6,300 | Transaction Deposits | \$ 40,000 |
| Short-term Securities | 15,000 | Short-term Time Deposits | 25,000 |
| Long-term Securities | 18,700 | Long-term Time Deposits | 25,000 |
| High Variable Loans | 20,000 | Borrowings | 3,000 |
| Medium Variable Loans | 20,000 | Equity Capital | 7,000 |
| Fixed Rate Loans | 20,000 | | <u>\$100,000</u> |
| | <u>\$100,000</u> | | |

Income Statement (000 omitted)

| | |
|-------------------|----------------|
| Revenues | \$12,470 |
| Interest Expenses | - 8,790 |
| Other Expenses | - <u>2,000</u> |
| Operating Income | 1,680 |
| Taxes (45%) | <u>756</u> |
| Net Income | <u>\$ 924</u> |

in long-term securities. Unfortunately, the \$18.7 million of long-term securities and \$20 million of fixed-rate loans had been invested in lower rate environments and had average yields of ten and twelve percent respectively.

The income statement for Smithville Bank was calculated from the account balance and rates available in the environment. For example, revenues are:

| <u>category</u> | <u>balance</u> | X | <u>yield</u> | = | <u>revenues</u> |
|-------------------------|----------------|---|--------------|---|-----------------|
| Cash and Due From Banks | \$ 6,300 | | 0% | | \$ 0 |
| Short-term Securities | 15,000 | | 12% | | 1,800 |
| Long-term Securities | 18,700 | | 10% | | 1,870 |
| High Variable Loans | 20,000 | | 15% | | 3,000 |
| Low Variable Loans | 20,000 | | 17% | | 3,400 |
| Fixed Rate Loans | 20,000 | | 12% | | <u>2,400</u> |
| Total revenues | | | | | \$12,470 |

Note that while returns on long-term securities and fixed-rate loans averaged ten and twelve percent respectively, increase in these accounts would earn fourteen and sixteen percent respectively. Interest expenses are similarly calculated:

| <u>category</u> | <u>balance</u> | X | <u>cost</u> | = | <u>expense</u> |
|-------------------------|----------------|---|-------------|---|----------------|
| Transaction Deposits | \$40,000 | | 6% | | \$2,400 |
| Short-Time Deposits | 25,000 | | 11% | | 2,750 |
| Long-Time Deposits | 25,000 | | 13% | | 3,250 |
| Borrowing | 3,000 | | 13% | | <u>390</u> |
| Total interest expenses | | | | | \$8,790 |

Operating income is total revenues less total interest expenses and other expenses. Net income is operating income less income taxes of forty-five percent.

Measuring Returns and Risks

The key questions now are how well has this bank performed, has it earned acceptable returns, and what risks has it taken to achieve these returns? Ten introductory return and risk measures are defined and calculated for Smithville Bank in Table 3. The first return measure is the interest margin in percentage terms, which is interest income minus interest expense divided by total assets. Interest income less both interest expense and other expenses divided by revenues is labeled net margin. This net margin times asset utilization (revenues divided

Table 3
INTRODUCTORY RETURN AND RISK MEASURES
(Smithville Bank figures)

| <u>Category</u> | <u>Equation</u> | <u>Calculations</u> | <u>Result</u> |
|------------------------|--------------------------------|----------------------------------|---------------|
| <u>Return Measures</u> | | | |
| Interest Margin | Int. Inc. - Int. Exp./Assets | $\frac{12,400 - 8,790}{100,000}$ | 3.61% |
| Net Margin | Net Income/Revenues | 924/12,470 | 7.41% |
| Asset Utilization | Revenues/Assets | 12,470/100,000 | 12.47% |
| Return on Assets | Net Income/Assets | 924/100,000 | .92% |
| Average Multiplier | Assets/Equity | 100,000/7,000 | 14.29X |
| Return on Equity | Net Income/Equity | 924/7,000 | 13.20% |
| <u>Risk Measures</u> | | | |
| Liquidity Risk | Short-term Securities/Deposits | 15,000/90,000 | 16.67% |
| Interest-rate Risk | I.S. Assets/ I.S. Liabilities | 55,000/68,000 | 0.81 |
| Credit Risk | Medium Loans/Assets | 20,000/100,000 | 20.00% |
| Capital Risk | Capital/Risk Assets | 7,000/78,700 | 8.89% |

by assets) equals return on assets. When the return on assets is multiplied by the leverage multiplier (assets divided by equity) the result is the return on equity. In my opinion, this return on equity (net income divided by equity capital) is the most important measure of banking returns because it is influenced by how well the bank has performed on all other return categories and because it indicates whether a bank can compete for private sources of capital in our economy.

The risk measures are related to the return measures, because in order to earn adequate returns a bank must take risks. The liquidity risk of a bank is approximated by comparing a proxy for the bank's liquidity needs, its deposits, with a proxy for the bank's liquidity sources, its short-term securities. While both variables are only rough approximations--funding loans may be a major liquidity need and purchasing liabilities may be an important source of liquidity--I believe the relationship is an indicator of most banks' liquidity risk. The tradeoffs which may exist between returns and risks are demonstrated by observing that a shift from short-term securities into long-term securities or loans would raise a bank's returns but would increase its liquidity risk. The reverse results would be true if short-term securities were increased.

The interest-rate risk of a bank is measured by the ratio of interest-sensitive assets to interest-sensitive liabilities. Particularly in periods of wide interest-rate movements, this ratio reflects the risk of lower returns. If a bank has a ratio above 1.0, the bank's returns will usually be lower if interest rates decline. On the other hand, a bank's returns will be lower if the bank has a ratio below 1.0 and interest rates increase. Given the difficulty of predicting interest rates, at least some banks have concluded the way to minimize interest-rate risk is to have an interest-sensitivity ratio of close to 1.0. Such a ratio may be hard for some banks to achieve and often may be reached only at the cost of lower returns on assets such as short-term securities or variable-rate loans.

The credit risk of a bank is estimated by observing the proportion of assets which are medium-quality loans. The relative amount of loan losses may be a better measure, but data are not available in this example. The credit risk is higher if the bank has more medium-quality loans, but returns are usually higher too. Returns would tend to be lower if the bank chose to lower its credit risk by having a smaller portion of its assets in medium-quality loans.

The capital risk of a bank can be measured by examining what percentage of the bank's risk assets are covered by its capital. The capital risk is inversely related to the leverage multiplier and, therefore, to the return on equity.

When a bank chooses (assuming this is allowed by its regulators) to take more capital risk, its leverage multiplier and return on equity, ceteris paribus, is higher. If the bank chooses (or is forced to choose) lower capital risk, its leverage multiplier and return on equity are lower.

Setting Objectives for Returns and Risks

Clearly returns are increased by increasing one or more of the four primary risks a bank may take. It is obvious that the funds manager would prefer the highest returns for a given level of risks and the lowest risks for a given level of returns. Two questions remain for the funds manager. What degree of total risks should a bank take in order to increase returns? How much of which type of risks should a bank take? The answer to these questions are difficult and not exact. For assistance, we can look at our own past performance, and ask if we are satisfied with the returns obtained and risks taken. We can find return and risk measures for similar individual banks or peer groups of banks, and compare these with similar measures for ourselves. But exact answers are hard to come by. Constraints, such as the nature of a bank's market, the level of competition it faces, the areas in which it has special management expertise, and the stance of its regulators, mean each bank has individual characteristics which affect its desired return-risk tradeoffs.

In my opinion, the first step for bank funds managers is to look at how other similar individual banks and groupings of banks have made their risk-return decisions. Any bank can obtain such information on other individual banks or peer groupings from the Federal Deposit Insurance Corporation, Federal Reserve, Comptroller's office, or numerous private bank service companies. Many banks' regulatory reports include a comparison with peer-group banks. The second step is to compare a bank's performance (return and risk) measures to those of selected similar banks. Significant variances between a bank's performance measures and those of similar banks should be justified. There are many justifiable reasons for differences--different markets, different management philosophies, etc.--however, many banks may find one or several areas for improvement. The final step is to set reasonable (challenging but attainable) objectives, given a bank's past performance, the performance of its peers, and its environment.

Assume^{that}/ after careful study of its past performance and that of its peers, Smithville bank decided on the performance objectives in the first column in Table 4. These objectives should be compared with the bank's actual performance for the period being examined (see Table 3). Smithville Bank's return on equity was very close to its objective; however, the composition for achieving this

Table 4

PERFORMANCE OBJECTIVES FOR SMITHVILLE BANK

| | <u>Objective</u> | <u>Actual</u> |
|--------------------------|------------------|---------------|
| <u>Return Measures</u> | | |
| Interest Margin | 4.00% | 3.61% |
| Net Margin | 8.00% | 7.41% |
| Asset Utilization | 12.50% | 12.47% |
| Return of Assets | 1.00% | .92% |
| Leverage Multiplier | 13.50X | 14.29X |
| Return of Equity | 13.50% | 13.20% |
| <u>Risk Measures</u> | | |
| Liquidity Risk | 23.00% | 16.67% |
| Interest-rate Risk | 1.00 | 0.81 |
| Credit Risk | 20.00% | 20.00% |
| Capital Risk | 10.00% | 8.89% |

target was slightly different from those objectives. The bank's interest margin (and resulting net margin and return on assets) was below its objective; however, an above-target leverage multiplier increased the return on equity closer to, but still below, the objective.

An analysis of the risk measures showed that the bank's liquidity and interest-rate risks were substantially different from its objectives. Smithville Bank was able to obtain its return on equity objective only by taking higher risks than desired in these areas, as well as greater capital risk to provide a higher leverage multiplier. The bank appears to be vulnerable to substantial increases in interest rates or loan demand. Based on the preceding analysis, Smithville Bank might set future goals such as increasing its net interest margin, increasing liquid assets, and balancing its interest-rate sensitivity position.

Examples of Return-Risk Tradeoffs

Two additional Smithville Bank examples illustrate the difficulty in obtaining conflicting goals and the tradeoffs between returns and risks taken by nearly every commercial bank. It is assumed that in the year following our initial example (see Table 2), Smithville's deposits grew \$10 million and its capital grew \$1 million. Available returns and expenses remained the same (see Table 1). The bank's funds management set its highest priorities on increasing the bank's liquidity position and on making the bank less vulnerable to interest-rate fluctuations. To achieve these objectives the bank chose to place all the newly attracted funds, less those required as reserves, into short-term securities. The resulting balance sheet, income statements, and return-risk measures are shown in Table 5.¹

Smithville Bank's funds management decisions improved its risk position measurably. The bank's liquidity risk, credit risk, and capital risk were all slightly better than the targeted objective. The bank's interest sensitivity position was moving from .81 to .90, which was toward its targeted goal of 1.00.

¹Revenues and interest expenses were calculated, as in the initial example, by multiplying the assets and liability accounts by the rates as shown in Table 1. Rates on long-term securities and fixed-rate loans remained at ten and twelve percent respectively.

Table 5
 EMPHASIS ON LIQUIDITY AND BALANCED INTEREST SENSITIVITY
 (for Smithville Bank)

Balance Sheet (000 omitted)

| <u>Assets</u> | | <u>Liabilities</u> | |
|-------------------------|------------------|--------------------------|------------------|
| Cash and Due from Banks | \$ 6,600 | Transaction Deposits | \$ 40,000 |
| Short Term Securities | 25,700 | Short-term Time Deposits | \$ 30,000 |
| Long-term Securities | 18,700 | Long-term Time Deposits | 30,000 |
| High Variable Loans | 20,000 | Borrowing | 3,000 |
| Medium Variable Loans | 20,000 | Equity Capital | 8,000 |
| Fixed Rate Loans | 20,000 | | |
| | <u>\$111,000</u> | | <u>\$111,000</u> |

Income Statement (000 omitted)

| | |
|-------------------|-----------------|
| Revenues | \$13,754 |
| Interest Expenses | 9,990 |
| Other Expenses | 2,000 |
| Operating | <u>\$ 1,764</u> |
| Taxes (45%) | 794 |
| Net Income | <u>\$ 970</u> |

Introductory Return and Risk Measures

| | <u>Objective</u> | <u>Previous</u> | <u>Emphasizing Liquidity</u> |
|------------------------|------------------|-----------------|------------------------------|
| <u>Return Measures</u> | | | |
| Interest Margin | 4.00% | 3.61% | 3.39% |
| Net Margin | 8.00% | 7.41% | 7.0 % |
| Asset Utilization | 12.50% | 12.47% | 12.39% |
| Return on Assets | 1.00% | .92% | .87% |
| Leverage Multiplier | 13.50X | 14.29X | 13.88X |
| Return of Equity | 13.50% | 13.20% | 12.12% |
| <u>Risk Measures</u> | | | |
| Liquidity Risk | 23.00% | 16.67% | 25.70% |
| Interest-rate Risk | 1.00 | .81 | .90 |
| Credit Risk | 20.00% | 20.00% | 18.02% |
| Capital Risk | 10.00% | 8.89% | 10.17% |

However, the other side of the bank's performance, its returns, had deteriorated. Both the interest margin and the net margin declined appreciably because the bank's use of the funds obtained emphasized the more liquid, variable-return securities which had lower yields than other alternatives. The resulting return on assets and return on capital fell to .87 percent and 12.12 percent respectively, well below the bank's goals of 1.00 percent and 13.50 percent. Thus, Smithville Bank was unable to obtain its risk objectives without hurting its return performance significantly. The bank's owners would probably be unhappy with such funds management decisions.

Using the same figures--Smithville's deposits grew \$10 million and its capital grew \$1 million with returns and expenses as in Table 1--it is assumed in the second example that the bank's funds management decided to emphasize increasing returns. The bank chose to invest the newly-attracted funds, less those required as reserves, into the three asset categories which produced the highest returns. The resulting balance sheet, income statement, and return-risk measures are shown in Table 6.²

The new funds management decisions improved Smithville Bank's returns appreciably. Interest margin improved slightly, but net margin and asset utilization improved appreciably. The resulting return on assets and return on capital increased to 1.05 percent and 14.63 percent respectively, well above the bank's objectives of 1.00 percent and 13.50 percent. The cost of obtaining these increased returns was taking risks considerably higher than in the previous year and than its objectives. Smithville's liquidity deteriorated further; its earnings were even more sensitive to interest-rate movements; and it was taking slightly above-average credit risk. The bank's capital risk improved slightly from the previous year; however, it was still significantly below the bank's objective. While the bank's owners might be happy with the higher returns, other parties, such as large depositors and regulators, might become concerned about the risks the bank was taking to obtain these returns.

²Revenues and interest expenses were calculated, as in the initial example, by multiplying the asset and liability accounts by the rates shown in Table 1. Rates on previously-held long-term securities and fixed-rate loans remained at ten and twelve percent, but newly acquired assets in these categories earned the current rates of fourteen and sixteen percent respectively.

Table 6

EMPHASIS ON PROFITABILITY
(for Smithville Bank)

Balance Sheet (000 omitted)

| <u>Assets</u> | | <u>Liabilities</u> | |
|----------------------------|------------------|--------------------------|------------------|
| Cash and Due from Banks | \$ 6,600 | Transaction Deposits | \$ 40,000 |
| Short-Term Securities | 15,000 | Short-Term Time Deposits | 30,000 |
| Long-Term Securities | 23,400 | Long-Term Time Deposits | 30,000 |
| High Variable Securities | 20,000 | Borrowing | 3,000 |
| Medium Variable Securities | 23,000 | Equity Capital | 8,000 |
| Fixed Rate Loans | 23,000 | | |
| | <u>\$111,000</u> | | <u>\$111,000</u> |

Income Statement (000 omitted)

| | |
|-------------------|-----------------|
| Revenues | \$14,118 |
| Interest Expenses | 9,990 |
| Other Expenses | 2,000 |
| Operating Income | \$ 2,128 |
| Taxes (45%) | 958 |
| Net Income | <u>\$ 1,170</u> |

Introductory Return and Risk Measures

| | <u>Objective</u> | <u>Previous</u> | <u>Emphasizing Returns</u> |
|------------------------|------------------|-----------------|--------------------------------|
| <u>Return Measures</u> | | | |
| Interest Margin | 4.00% | 3.61% | 3.72% |
| Net Margin | 8.00% | 7.41% | 8.29% |
| Asset Utilization | 12.50% | 12.47% | 12.72% |
| Return on Assets | 1.00% | .92% | 1.05% |
| Leverage Multiplier | 13.50X | 14.29X | 13.88X |
| Return on Equity | 13.50% | 13.20% | 14.63% |
| <u>Risk Measures</u> | | | |
| Liquidity Risk | 23.00% | 16.67% | 15.00% |
| Interest-Rate Risk | 1.00 | .81 | .79 |
| Credit Risk | 20.00% | 20.00% | 20.72% |
| Capital Risk | 10.00% | 8.89% | 8.95% |

Conclusions

With the aid of a computer, I have tried numerous variations of the Smithville Bank example--changing the bank's liability structure, increasing or decreasing its capital position, varying the external environment so that rates are higher or lower, etc. The results are always similar. To increase its returns, the bank must take additional risk. The job of bank funds management is to decide which risks it is willing to take in order to achieve acceptable returns. The purpose of this reading was to illustrate how to measure returns and risks and to show the tradeoffs between returns and risks. The final reading in this book gives further advice on which type of risks different banks should take to achieve acceptable returns.

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